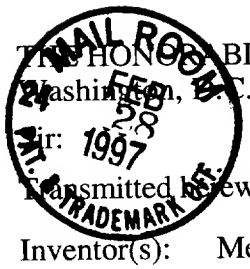
Docket No. 002410.P017
Express Mail No. EM531483810US



THE HONORABLE COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

Sir:

Transmitted herewith for filing is the Patent Application of:

Inventor(s): Me Van Le, William E. Wevers

For: METHOD AND APPARATUS FOR PROVIDING POSITIONAL INFORMATION ON A DISK

Enclosed are:

- ☒ 5 sheets of Formal Drawing(s) including 1-4C figures.
- ☒ An Assignment of the invention to: SAMSUNG ELECTRONICS, LTD.
- ☒ A Declaration and Power of Attorney.
- ☐ A Verified Statement to establish Small Entity Status under 37 CFR 1.9 and 37 CFR 1.27.
- ☐ _____

The Filing Fee has been calculated as shown below:

	(Col. 1)	(Col. 2)	SMALL ENTITY		OTHER THAN A SMALL ENTITY	
For:	No. Filed	No. Extra	RATE	FEE	RATE	FEE
Basic Fee:	-	-	-	$385.00	-	$770.00
Total Claims:	20	0	$11.00	$0.00	$22.00	$0.00
Indep. Claims:	3	0	$40.00	$0.00	$80.00	$0.00
☐ Multiple Dep. Claim(s) Presented			$130.00	$0.00	$260.00	$0.00
*If the difference in (Col. 1) is less than zero, enter "0" in (Col. 2)			Total:	$0.00	Total:	$770.00

- ☒ A check in the amount of $770.00 to cover the filing fee is enclosed.
- ☒ A check for $40.00 covering Recordation of Assignment is enclosed, along with the Assignment Cover Sheet.
- ☒ The Commissioner is hereby authorized to charge payment of the following fees associated with the this communication or credit any overpayment to our Deposit Account No. 02-2666. A duplicate copy of this sheet is enclosed.
  - ☒ Any additional filing fees required under 37 CFR 1.16.
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☒ Any extension or petition fees under 37 CFR §1.17.

☒ Any filing fees under 37 CFR §1.16 for presentation of extra claims.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN

Date: February 28, 1997

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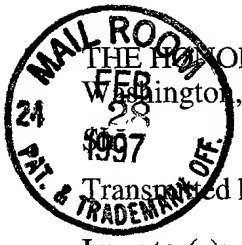

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UNITED STATES PATENT APPLICATION

FOR

METHOD AND APPARATUS FOR PROVIDING POSITIONAL INFORMATION ON A DISK

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770/101A

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates in general to disk storage systems and more particularly, to a method and apparatus for providing positional information on a disk in a hard drive assembly.

2. Description of the Related Art

Disk drives are magnetic recording devices used for the storage of information. The information is typically recorded on concentric tracks on either surface of one or more magnetic recording disks. To facilitate the storage and retrieval of data in an orderly manner, disks are typically organized in blocks called sectors. These sectors are located on the disk by a set of unique specifiers called cylinder (or track), head (or side) and sector number. The disks are rotatably mounted to a spin motor and information is accessed by means of read/write heads that are mounted to actuator arms which are rotated by a voice coil motor. The voice coil motor is excited with a current to rotate the actuator and move the heads.

The movement of the actuator is controlled by a servo system, utilizing servo information recorded on one or more of the magnetic recording disks. By reading this servo information, the actual radial positions of the heads can be determined, and after comparison with the desired head radial positions, control signals can be sent to move the actuator accordingly. Servo information

is typically stored on a disk in one of two ways. In the first, a dedicated servo system, a set of several tracks on the disk or the entire disk surface, is reserved exclusively for storing information associated with the characteristic of the particular drive. Such information includes servo parameters and read/write channel parameters. A servo head reads this information to provide a continuous signal indicating the position of the servo head with respect to the servo disk. In the second type of servo system, the embedded servo system, sectors of servo information are interspersed with sectors of data on each disk surface. As a read head follows the data track around, it regularly reads a fresh sample of servo information from each servo sector with which to control its position.

Figure 1 illustrates a typical sector on a disk of a hard disk drive. As shown, a typical sector 10 has a preamble field 20 which includes automatic gain control (AGC) information and synchronization information, a servo address mark 22 which signifies the beginning of a sector, an index field 24 which indicates the beginning of the first sector of the track, an identification field 26 which includes identification bits, a head identification field 28 for identification of head location, a gray code field 30 that identifies the particular cylinder (tracks) of the sector, a servo bit field 32 which includes a number of servo bits A, B, C, D, and a data field 34 which contains the data. The servo bits A, B, C and D are used to maintain the read/write head on the centerline CL of a

corresponding track. The identification field 26 typically includes an index bit and 7 bits of angular position information; the head identification field 28 typically includes 3 bits of data for identifying the head (or side) position of the disk pack and the gray code field 30 typically includes 13 bits of data for providing track identification. In conventional disk drives, absolute positional information is stored in graycode in the gray code field 30 of a particular sector 10. Due to power consumption, cost and throughput concerns, reduction of media space used in providing the servo information is highly desirable. However, most of the segments of the sector 10 are head and/or media dependent and reduction of these segments is difficult.

Accordingly, there is a need in the technology for a method and apparatus for providing servo information on a disk in a hard drive assembly while reducing the media space required for the provision of such information.

BRIEF SUMMARY OF THE INVENTION

The present invention is a method and apparatus for providing positional information of a disk. The disk has at least one side with a plurality of tracks, each having a first burst in a first servo field and a second burst in a second servo field. The first burst provides a first portion of track position information while the second burst provides a second portion of track position information. When combined, the first and second portions provide a position of a corresponding track. Each track further includes a third and a fourth burst that provides a first portion and a second portion of disk side position information. When combined, the first and second portions of disk side position information provide the disk side position of the disk. Each track also includes a burst that provides the quadrant position of the disk. In one embodiment, the first and second bursts are located on consecutive sectors, and each track includes a servo sector sequence burst with a sector sequence number that identifies the sequence position of the consecutive sectors. The first portion, the second portion and their corresponding sector sequence number in combination provide a position of a corresponding track.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a typical data sector of a disk in a disk drive assembly of the prior art.

Figure 2 is a top view of a hard disk drive assembly which utilizes the apparatus and method of the present invention.

Figure 3A illustrates exemplary sectors on heads H0 - H3 (sides 1-4) of the disk pack 100 of Figure 2.

Figure 3B illustrates an enlarged view of a typical sector of on one side of the disk pack 100 of Figure 3A as provided in accordance with the teachings of the present invention.

Figure 4A illustrates a plurality of consecutive sectors on one side of the disk pack 100, in accordance with the teachings of the present invention.

Figure 4B illustrates four bits of head position information as provided by the SDAT fields of sectors 2 and 3 in Figure 4A respectively.

Figure 4C illustrates the thirteen bits of track position information, of which bits 8-13 are provided by the SDAT fields of sectors 4-6 of Figure 4A and of which bits 0-7 are provided by the Graycode field from each sector of Figure 4A.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is an apparatus and method for

Referring to the drawings more particularly by reference numbers, Figure 2 illustrates a hard disk drive 50 which utilizes the method of the present invention. The disk drive 50 includes a disk pack 100 with a plurality of disks 102 that are collectively rotated by a spin motor 104. The spin motor 104 is mounted to a base plate 106. Also mounted to the base plate 106 is an actuator arm assembly 108. The actuator arm assembly 108 includes a number of read/write (R/W) heads 110a-d mounted to corresponding flexure arms 112. The flexure arms 112 are attached to an actuator arm 114 that can rotate about a bearing assembly 116. The assembly 108 also contains a voice coil motor 118 which moves the heads 110a-d collectively relative to the disks 102. There is typically a single head 110a, 110b, 110c, or 110d for disk head side H0, H1, H2 or H3 (not shown), respectively, of the disk pack 100. The spin motor 104, voice coil motor 118 and the R/W heads 110a-d are coupled to a number of electronic circuits 120 mounted to a printed circuit board 122. The electronic circuits 120 typically include a read channel chip, a microprocessor-based controller and a random access memory (RAM) device.

As shown in Figure 3A, data is typically stored within sectors 140_1, 140_2 and 140_3 of radially concentric tracks located across any one of the disk heads H0-H3 of the disk pack 100. For discussion purposes, any one of the sectors 140_1, 140_2 and 140_3

will be referred to as sector 140. In one embodiment, as shown in Figure 3B, each sector 140 has a preamble field 150 which includes automatic gain control (AGC) information and synchronization information, an address mark 152 which signifies the beginning of the sector 140, an index field 154 which indicates the beginning of the first sector of the track, a servo sector sequence number (SSN) field 156 that identifies the sector sequence location number of sector 140 as identified among a plurality of consecutive sectors, a servo multiplex data (SDAT) field 158 that provides the higher order bit information related to positional information of the particular cylinder (track) of the sector 140, a gray code field 160 that provides the lower order bit information related to positional information of the particular cylinder (track) of the sector 140, a synchronization field 162, a servo bit field 164 which includes a number of servo bits A, B, C, D, and a data field 166 which contains the data. For present purposes, fields 150-164 will be referred to as the servo field while field 166 will be referred to as the data field. The electronic circuits 120 (see Figure 2) utilize the servo bits A, B, C and D to maintain the heads 110a-d on the centerline CL of a corresponding track. The heads 110a-d can magnetize and sense the magnetic field of the disk heads H0-H3 to as to provide the information located on the above-described fields 150-166.

In one embodiment, positional information is provided by reading the SSN field 156, the SDAT field 158 and the graycode field 160 of six consecutive bursts of servo data. Table 1

illustrates an example of positional information that is provided in the SSN field 156, the SDAT field 158 and the graycode field 160, and the interrelationship between the fields. Together, the information located in the SSN field 156, the SDAT field 158 and the graycode field 160 provide a matrix of positional information for identifying the quadrant, the head and track position of the disk pack 100.

As shown in Table 1, there are 72 servo sectors on an exemplary head, head 4 (H3) of the disk pack 100, each labeled from 0-71. The 72 servo sectors are divided into groups each having six consecutive sectors. Each of the six consecutive sectors can be identified by an SSN of 0-7, since a minimum of 3 bits are required, as provided in the SSN field 156 of each sector 140 (see Figure 3B). As discussed earlier, the (SDAT) field 158 provides the higher order bit information related to positional information of the particular cylinder (track) of the sector 140, while the gray code field 160 provides the lower order bit information related to positional information of the particular cylinder (track) of the sector 140.

In one embodiment, index information is provided in field 156_0 of sector 0 as 7 (binary 111). In one alternate embodiment, index information is provided in both sectors 0 and 1. In this case, the index information is provided in SSN field 156_0 as 7 (binary 111) and in SSN field 156_1, as 6 (binary 110).

Table 1

Example of data in servo pattern at Cylinder 24CDH, Heads 4.
Binary CDH = Graycode CDH
Binary 24H = Graycode 26H

Servo Sector	SSN	SDAT <1:0>	OFFSET <7:0>	COMMENTS
0	7	1,1	CDH	Index position, SSN = 7, SDAT = 00 for 1st 1/4 rev.
1	1	1,0	CDH	SDAT = Hd <3:02>
2	2	0,1	CDH	SDAT = Hd <1:0>
3	3	1,0	CDH	SDAT = Cyl <13:12>
4	4	0,1	CDH	SDAT = Cyl <11:10>
5	5	1,0	CDH	SDAT = Cyl <9:8>
6	0	0,0	CDH	SSN = 0 so SDAT = 0
7	1	1,0	CDH	SDAT = Hd <3:2>
8	2	0,1	CDH	SDAT = Hd <1:0>
9	3	1,0	CDH	SDAT = Cyl <13:12>
10	4	0,1	CDH	SDAT = Cyl <11:10>
11	5	1,0	CDH	SDAT = Cyl <9:8>
12	0	0,0	CDH	⋮
13	1	1,0	CDH	
...	...	...	...	
18	0	0,1	CDH	SDAT = 01 for 2nd 1/4 rev.
...	...	...	...	
36	0	1,0	CDH	SDAT = 10 for 3rd 1/4 rev.
...	...	...	...	
54	0	1,1	CDH	SDAT = 11 for 4th 1/4 rev.
...	...	...	...	⋮
68	2	0,1	CDH	
69	3	0,0	CDH	
70	4	0,1	CDH	
71	5	0,1	CDH	

In the present example, the combination of SSN = 0 and an SDAT number identifies the quadrant position on a disk in the disk pack 100. For example, the combination of SSN = 0 and SDAT = 00 identifies a particular position as the first quadrant of a disk; while the combination of SSN = 0 and SDAT = 01 identifies a particular position as the second quadrant of the disk. Similarly, the combination of SSN = 0 and SDAT = 10 identifies a particular position as the third quadrant of the disk; while the combination of SSN = 0 and SDAT = 11 identifies a particular position as the fourth quadrant of the disk. However, where SSN = 7 and SDAT = 00, it indicates that a particular position is the first sector in the first quadrant of the disk.

In addition, the combination of SSN = 1 or SSN = 2 with an SDAT number identifies a particular position as the head (or side position) of the disk pack 100. With reference to Table 1, the combination of SSN = 1 and SDAT = 10 identifies a particular position as head 4 or H3 of the disk pack 100, while the combination of SSN = 1 and SDAT = 01 identifies a particular position as head 3 or H2 of the disk pack 100. Similarly, the combination of SSN = 2 and SDAT = 01 identifies a particular position as head 2 or H1 of the disk pack, while the combination of SSN = 2 and SDAT = 10 identifies a particular position as head 1 or H0 of the disk pack 100.

Finally, the combination of SSN = 3, 4 or 5 and an SDAT number provides the higher order bit information related to

positional information of the particular cylinder (track) of a disk in the disk pack 100. For example, the combination of SSN = 3 and SDAT = 10 or 01 provides the position information of bits 13 and 12, where the bit positions are identified from 0 - 13 (the 14th and 13th bits among 14 bits) of graycode information required to completely identify the cylinder or track on a disk. Similarly, the combination of SSN = 4 and SDAT = 01 or 10 provides position information of bits 11 and 10 (the 12th and 11th bits among 14 bits) of the graycode information required to completely identify the cylinder, while the combination of SSN = 5 and SDAT = 10 or 01 provides positional information for bits 9 and 8 (the 10th and 9th bits among 14 bits) of graycode information required to completely identify the cylinder. The remaining 8 bits of graycode information is located in the graycode field 160 located in each sector 140.

Figure 4A illustrates an example of how the present invention may be implemented utilizing six consecutive sectors on a typical track. The six sectors, SECTORS 0-5, each has an SSN field 156_0 - 156_5, an SDAT field 158_0 - 158_5 and a graycode field 160_0 - 160_5. Each SSN field 156_0 - 156_5 provides 3 bits of information related to the sector sequence position of each sector SECTORS 0-5 among the 6 sectors, while each SDAT field 158_0 - 158_5 provides 2 bits of information which provides any of the following information when used in combination with the SSN number: (1) identifies the quadrant position of a disk in the disk pack 100; (2) identifies the head (or side) of the disk pack 100 or (3) provides 2 of six

upper bits of information related to the track position information; and each graycode field 160_0 - 160_5 provides the 8 lower bits of information related to track position information.

As discussed earlier, the combination of SSN = 0 and an SDAT number identifies the quadrant position on a disk in the disk pack 100. In addition, the combination of SSN = 1 or SSN = 2 with an SDAT number identifies a particular position as the head (or side position) of the disk pack 100. Finally, the combination of SSN = 3, 4 or 5 and an SDAT number provides the higher order bit information related to positional information of the particular cylinder (track) of a disk in the disk pack 100.

Figure 4B illustrates the 4 bits of information that may be obtained from two of the six sectors, SECTORS 1 and 2, which together identifies head (or side) position of a disk pack 100. As shown, when the SSN field 156 preceding an SDAT field 158 indicates that the SSN is 1 (binary 001), the following SDAT field 158 will provide the upper 2 bits of head positional information. When the SSN field 156 preceding an SDAT field 158 indicates that the SSN is 2 (binary 010), the following SDAT field 158 will provide the lower 2 bits of head positional information. After reading the SSN fields 156_1 and 156_2 of the sectors SECTORS 1 and 2, one will obtain the head position information of a particular location of the disk pack 100.

Figure 4C illustrates the 14 bits of information that may be obtained from three of six sectors, SECTORS 3 - 5, which together

identifies the track (or cylinder) position of a disk pack 100. As shown, each graycode field 160_0 - 160_5 provides the 8 lower bits of information related to track position information. When one of the R/W heads 100a-d is reading from a track within a particular band of tracks, where there are 256 tracks in one band, the information from the 8 lower bits is sufficient to identify the position of the head. However, when any of the R/W heads 100a-d is moving from one band to another, additional information is required to identify its location. As shown, when the SSN field 156 preceding an SDAT field 158 indicates that the SSN is 3 (binary 011), the following SDAT field will provide the two uppermost bits (bits 13 and 12) of the 14 bits of data required to provide track position. When the SSN field 158 indicates that the SSN is 4 (binary 100), the following SDAT field 158 will provide the following two uppermost bits (bits 11 and 10) of the 14 bits of data required to provide track information. Finally, when the SSN field 156 indicates that the SSN is 5 (binary 101), the following SDAT field 158 will provide the last of the uppermost bits (bits 9 and 8) of the 14 bits of data required to provide track position. Thus, by scanning the SSN field 156, the SDAT field 158 and the graycode field 160 of at least 6 consecutive sectors as provided by the present invention, complete positional information of a particular location on the disk pack 100 may be obtained.

Through the implementation of the technique of the present invention, servo information on a disk in a hard drive assembly may be

provided while reducing the media space required for the provision of such information. As a result, more media space may be utilized for the storage of data.

While certain exemplary embodiments have been described and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive on the broad invention, and that this invention not be limited to the specific constructions and arrangements shown and described, since various other modifications may occur to those ordinarily skilled in the art.

CLAIMS

What is claimed:

1. A disk for a hard disk drive, comprising:

a disk having at least one side with a plurality of tracks, each of said tracks having a first burst in a first servo field and a second burst in a second servo field, said first burst providing a first portion of track position information and said second burst providing a second portion of track position information, said first and second portions in combination providing a position of a corresponding track.

2. The disk as recited in claim 1, wherein said first burst and said second bursts are located on consecutive sectors of each track.

3. The disk as recited in claim 2, wherein each track further comprises a third burst that provides a sector sequence number that identifies the sequence position of each of said consecutive sectors.

4. The disk as recited in claim 1, wherein each track further comprises a third burst that provides a third portion of track position information, said first, second and third portions in combination providing a position of a corresponding track.

5. The disk as recited in claim 4, wherein said first, said second and said third bursts are located on consecutive sectors of each track.

6. The disk as recited in claim 5, wherein each track further comprises a fourth burst that provides a sector sequence number that identifies the sequence position of each of said consecutive sectors; said first, second and third portions and their corresponding sequence numbers in combination providing a position of a corresponding track.

7. The disk as recited in claim 1, wherein each track further comprises a third burst that provides a quadrant position of said disk.

8. The disk as recited in claim 1, wherein said disk has a second side with a second plurality of tracks, wherein each track on each side of said disk includes said first burst and said second burst.

9. The disk as recited in claim 2, wherein each track on each side of said disk further comprises a third burst and a fourth burst, said third and fourth bursts providing a first portion and a second portion of disk side position information respectively, said first and second portions of disk side position information in combination providing a position of a side of the disk.

10. A hard disk drive, comprising:

a housing;

a spin motor mounted to said housing;

an actuator arm mounted to said spin motor;

a disk attached to said spin motor, said disk having at least one side with a plurality of tracks, each of said tracks having a first burst in a first field and a second burst in a

second field, said first burst providing a first portion of track position information and said second burst providing a second portion of track position information, said first and second portions in combination providing a position of a corresponding track; and

a read/write head mounted to said actuator arm for reading said at least one side of said disk.

11. The hard disk drive as recited in claim 1, wherein said first burst and said second bursts are located on consecutive sectors of each track.

12. The hard disk drive as recited in claim 11, wherein each track further comprises a third burst that provides a sector sequence number that identifies the sequence position of each of said consecutive sectors.

13. The hard disk drive as recited in claim 10, wherein each track further comprises a third burst that provides a third portion of track position information, said first, second and third portions in combination providing a position of a corresponding track.

14. The hard disk drive as recited in claim 13, wherein said first, said second and said third bursts are located on consecutive sectors of each track.

15. The hard disk drive as recited in claim 14, wherein each track further comprises a fourth burst that provides a sector sequence number that identifies the sequence position of each of said consecutive sectors; said first, second and third portions and their corresponding sequence numbers in combination providing a position of a corresponding track.

16. The hard disk drive as recited in claim 10, wherein said disk further comprises a second side with a second plurality of tracks, wherein each track on each side of said disk includes said first burst and said burst, each track on each side of said disk further including a third burst and a fourth burst, said third and fourth bursts providing a first portion and a second portion of disk side position information respectively, said first and second portions of disk side position information in combination providing a position of a side of the disk; and

wherein said hard disk drive further comprises a second read/write head mounted to said actuator arm for reading said second side of said disk.

17. A method for providing servo information on a disk in a hard disk drive, comprising the steps of:

a) providing a disk having a at least one side with a plurality of tracks, each of said tracks having a first in a first servo field and a second burst in a second servo field, said first burst providing a first portion of track position information and said second burst providing a second portion of track position information;

b) reading said first burst;

c) reading said second burst; and

d) combining said first and said second portions to provide a position of a corresponding track.

18. The method as recited in claim 17, wherein step a) further comprises the step of: providing a third burst that provides a sector sequence number that identifies the sequence position of each of said consecutive sectors;

wherein the method further comprises the steps of: reading said third burst, after step c); and

the step of: e) combining said first, and second portions and their corresponding sequence numbers to provide a position of a corresponding track.

19. The method as recited in claim 17, wherein step a) further comprises the step of providing a third burst that provides a quadrant position of said disk.

20. The method as recited in claim 17, wherein in step a), said disk has a second side with a second plurality of tracks, wherein each track on each side of said disk includes said first burst and said second burst; and wherein each track on each side of said disk further comprises a third burst and a fourth burst, said third and fourth bursts providing a first portion and a second portion of disk side position information respectively; wherein said method further comprises the step of:

e) reading said first and second portions of disk side position information; and

f) combining said first and second portions to provide a position of a side of the disk.

ABSTRACT

The present invention is a method and apparatus for providing positional information of a disk. The disk has at least one side with a plurality of tracks, each having a first burst in a first servo field and a second burst in a second servo field. The first burst provides a first portion of track position information while the second burst provides a second portion of track position information. When combined, the first and second portions provide a position of a corresponding track. Each track further includes a third and a fourth burst that provides a first portion and a second portion of disk side position information. When combined, the first and second portions of disk side position information provide the disk side position of the disk. Each track also includes a burst that provides the quadrant position of the disk. In one embodiment, the first and second bursts are located on consecutive sectors, and each track includes a servo sector sequence burst with a sector sequence number that identifies the sequence position of the consecutive sectors. The first portion, the second portion and their corresponding sector sequence number in combination provide a position of a corresponding track.

FIG. 1 (PRIOR ART)

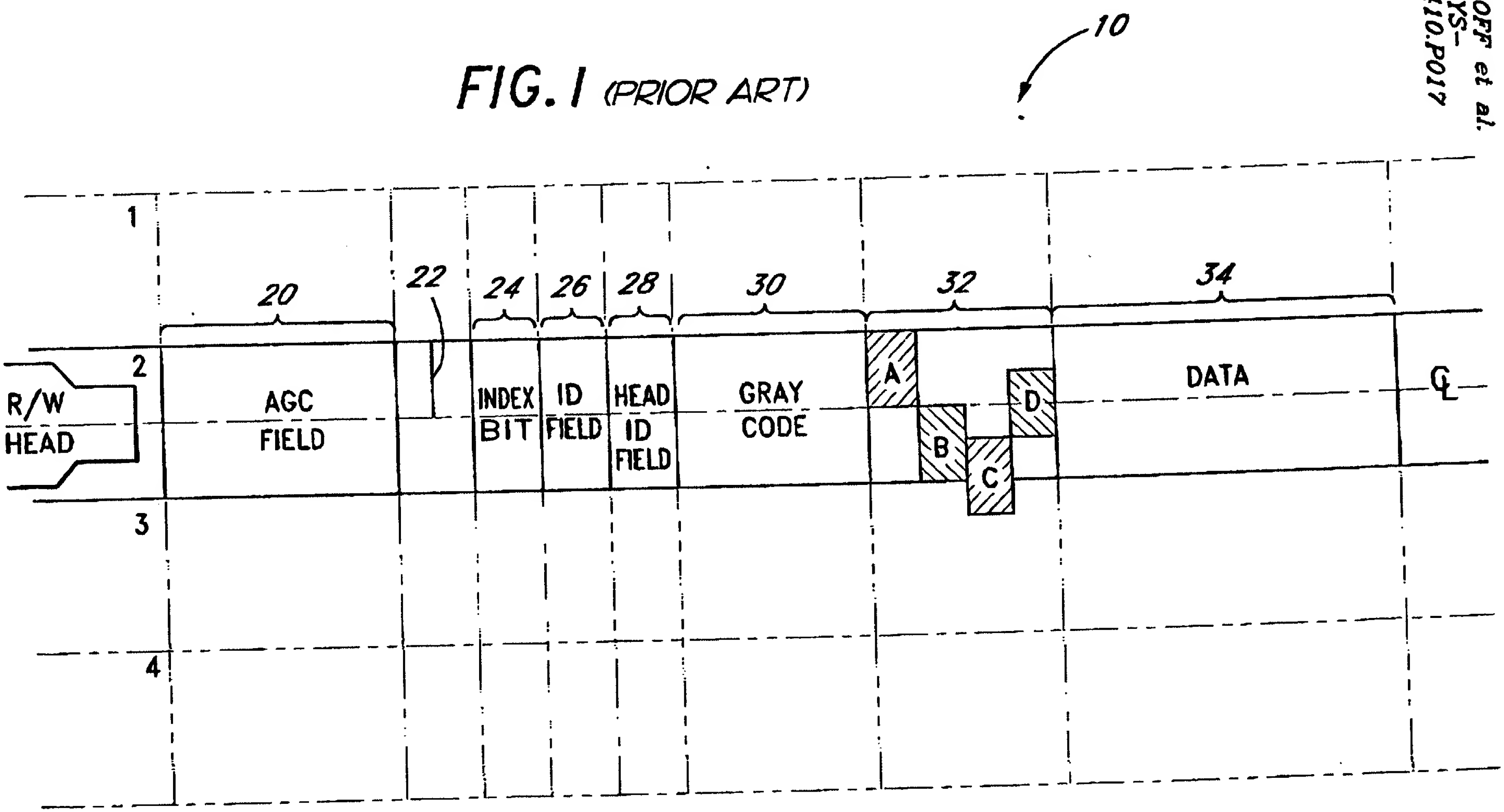
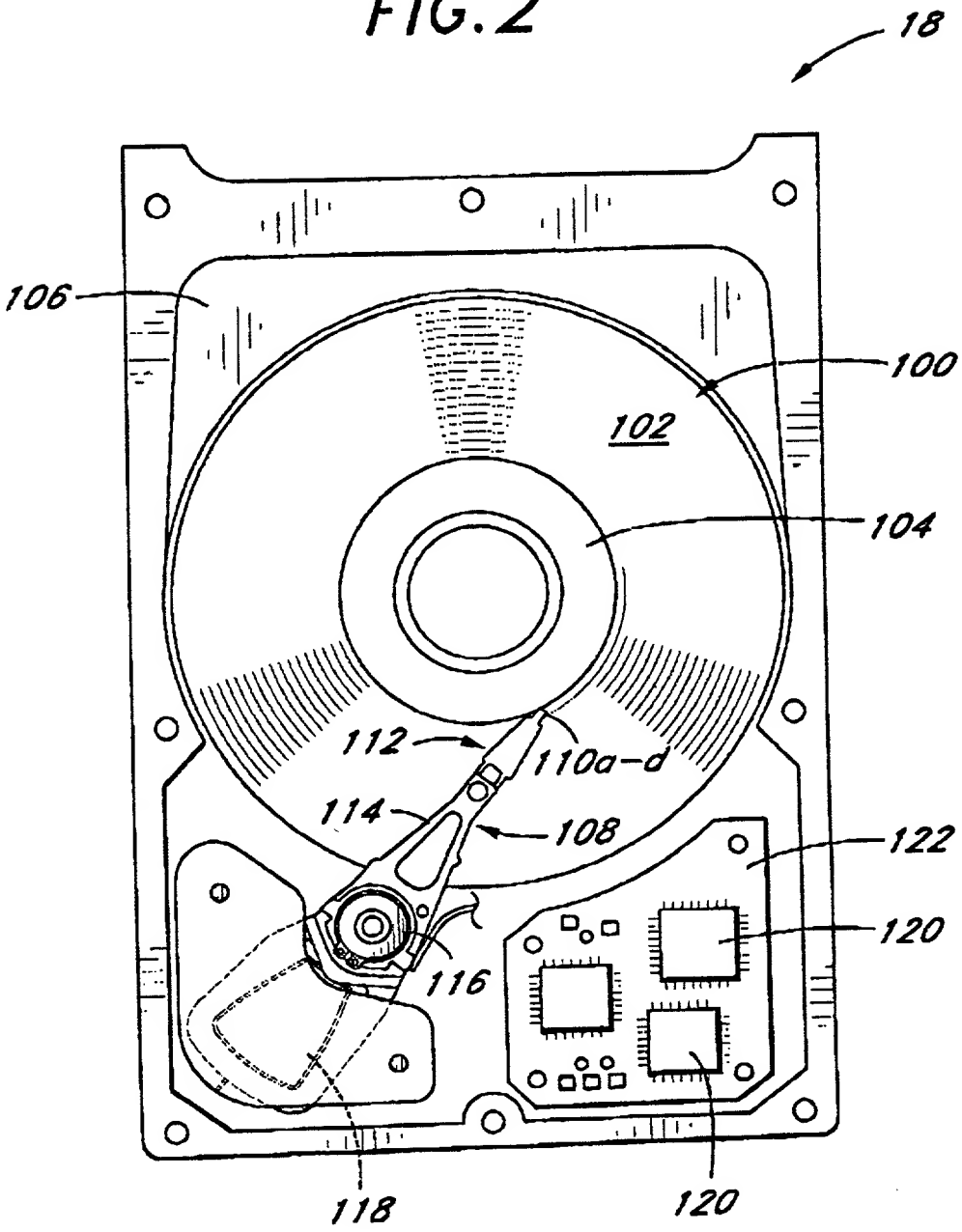


FIG. 2



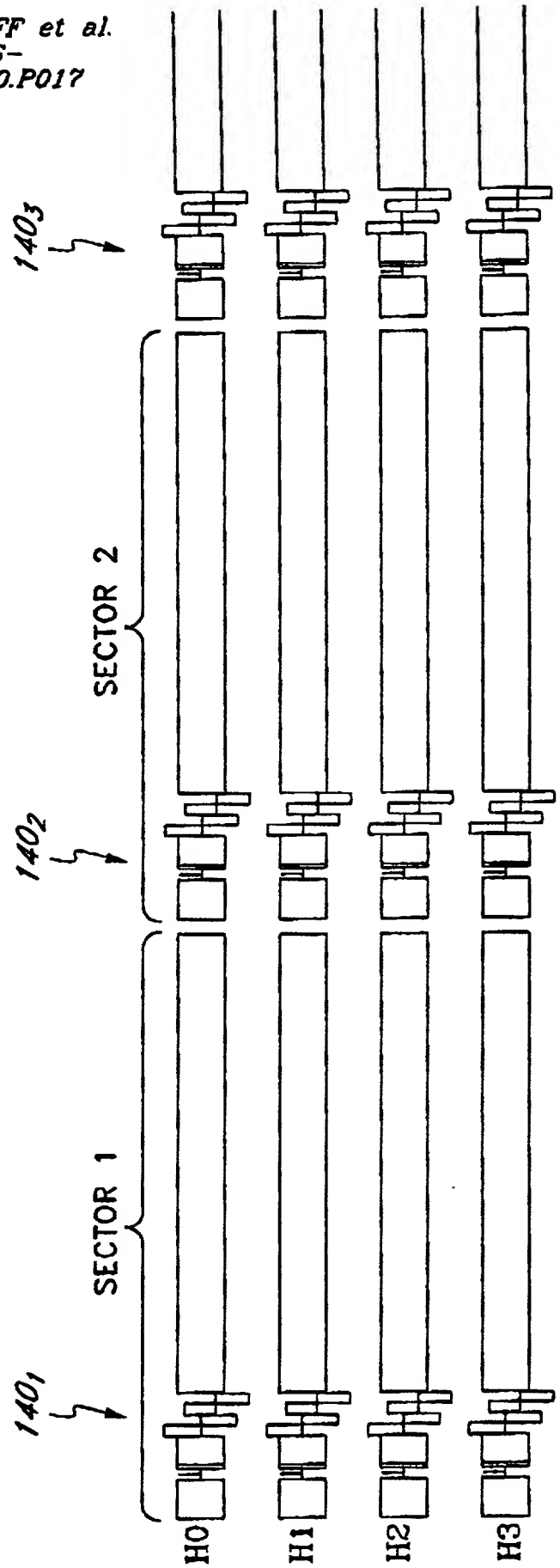


FIG. 3A

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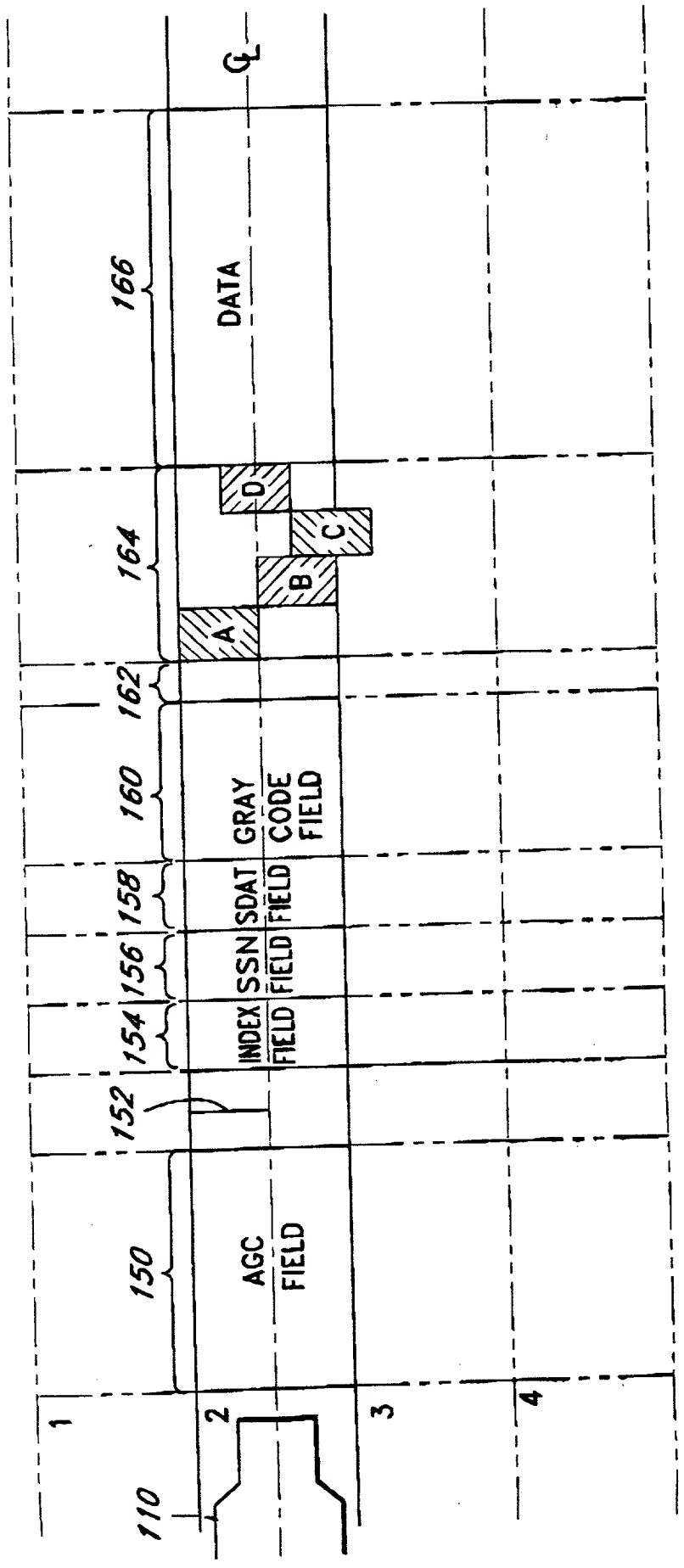

FIG. 3B

FIG. 4

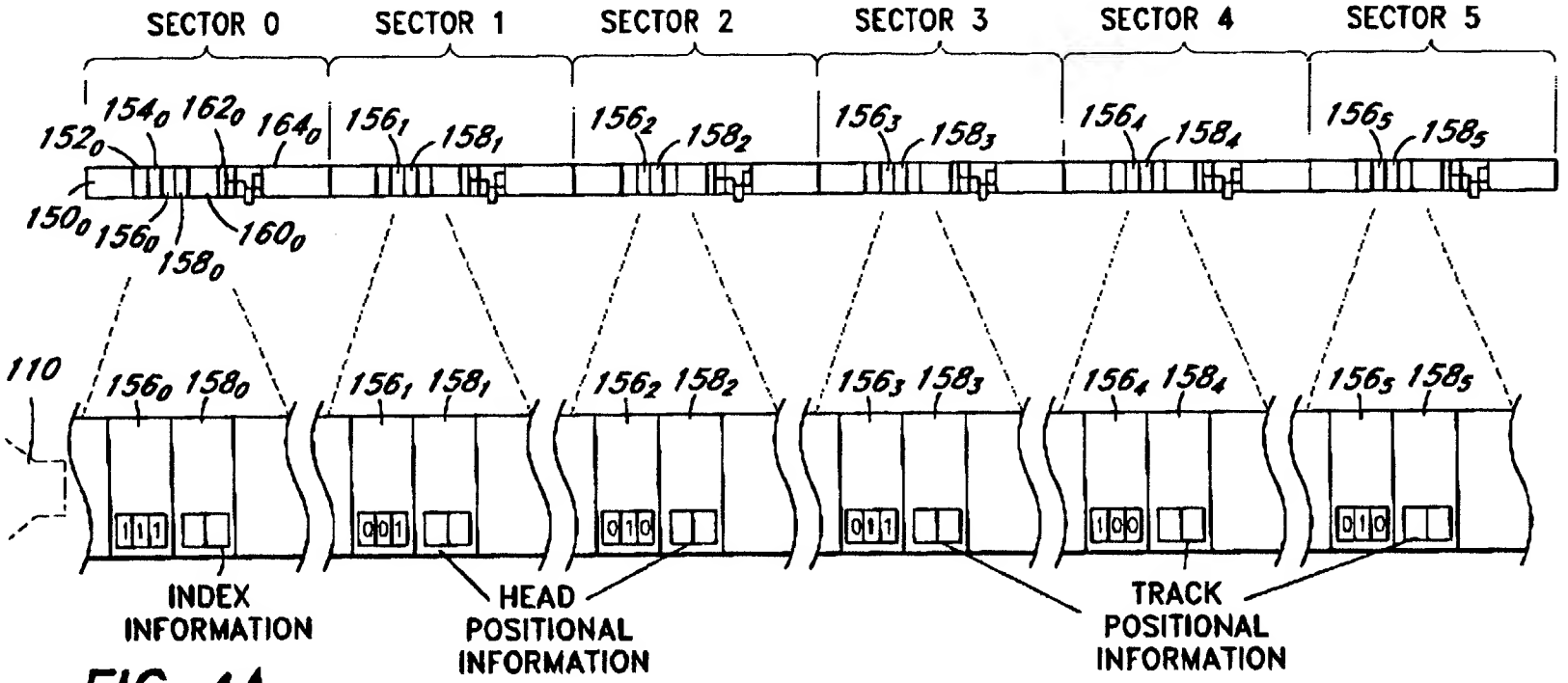

FIG. 4A

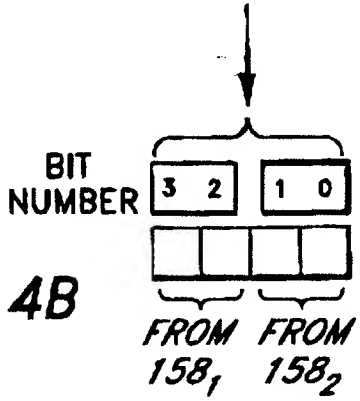

FIG. 4B

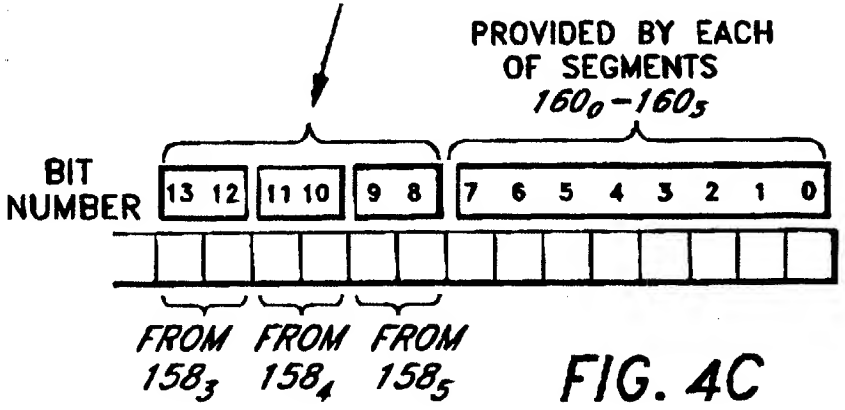

FIG. 4C

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name,

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD AND APPARATUS FOR PROVIDING POSITIONAL INFORMATION ON A DISK

the specification of which

__X__ is attached hereto.
_____ was filed on _____ as
Application Serial No. _____
and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I do not know and do not believe that the same was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119, of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing

date of this application:

(Application Serial No.)	(Filing Date)	(Status -- patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status -- patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status -- patented, pending, abandoned)

I hereby appoint BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, a firm including: Aloysius T. C. AuYeung, Reg. No. 35,432; William Thomas Babbitt, Reg. No. 39,591; Jordan Michael Becker, Reg. No. 39,602; Bradley J. Bereznak, Reg. No. 33,474; Michael A. Bernadicou, Reg. No. 35,934; Roger W. Blakely, Jr., Reg. No. 25,831; Gregory D. Caldwell, Reg. No. 39,926; Kent M. Chen, Reg. No. 39,630; Lawrence M. Cho, Reg. No. 39,942; Thomas M. Coester, Reg. No. 39,637; Roland B. Cortes, Reg. No. 39,152; William Donald Davis, Reg. No. 38,428; Daniel M. De Vos, Reg. No. 37,813; Karen L. Feisthamel, Reg. No. 40,264; David R. Halvorson, Reg. No. 33,395; Eric Ho, Reg. No. 39,711; George W Hoover II, Reg. No. 32,992; Eric S. Hyman, Reg. No. 30,139; Dag H. Johansen, Reg. No. 36,172; Stephen L. King, Reg. No. 19,180; Dolly M. Lee, Reg. No. 39,742; Michael J. Mallie, Reg. No. 36,591; Kimberley G. Nobles, Reg. No. 38,255; Ronald W. Reagin, Reg. No. 20,340; James H. Salter, Reg. No. 35,668; William W. Schaal, Reg. No. 39,018; James C. Scheller, Reg. No. 31,195; Maria McCormack Sobrino, Reg. No. 31,639; Stanley W. Sokoloff, Reg. No. 25,128; Allan T. Sponseller, Reg. No. 38,318; Steven R. Sponseller, Reg. No. 39,384; David R. Stevens, Reg. No. 38,626; Edwin H. Taylor, Reg. No. 25,129; Lester J. Vincent, Reg. No. 31,460; John Patrick Ward, Reg. No. 40,216; Ben J. Yorks, Reg. No. 33,609; and Norman Zafman, Reg. No. 26,250; my attorneys; and Gary B. Goates, Reg. No. 35,159; Michael Anthony DeSanctis, Reg. No. 39,957; Charles E. Shemwell, Reg. No. 40,171; Edwin A. Sloane, Reg. No. 34,728; and Judith A. Szepesi, Reg. No. 39,393; my patent agents, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025, telephone (714) 557-3800, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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